METHODS, USED BY PUBLIC COMMISSIONS WITH ELECTRIC LIGHT, POWER, & RAILWAY CO'S.

BY
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THE METHODS USED BY PUBLIC UTILITY COMMISSIONS in ARRIVING AT THE PROPER DEPRECIATION AND VALUATION of ELECTRIC LIGHT, POWER, and RAILWAY COMPANIES and THEIR EFFECT ON RATE REGULATION.

A THESIS

PRESENTED BY

Emil J. Schmidt

a n d

DeLos DeTar

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In the Matter of the Application of James M. Wallace, Adrian Iselin, Edmund D. Randolph, Mortimer L. Schiff, James Timpson, And Harry Bronner, composing the Bondholders' Committee of bonds issued under the First Consolidated Mortgage of the Third Avenue Railroad Company, dated May 15, 1900, for approval of the issue of $16,516,800 of Refunding Mortgage Bonds, $32,000,000 of Adjustment Mortgage 5 per cent Cumulative Bonds, and $20,000,000 of Capital Stock by a new company contemplated in the plan of reorganization of the property of said Third Avenue Railroad Company. (Case No. 1126)

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Do. (Case No. 351)

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Do. (Case No. 352)

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The Methods used by Public Utility Commissions in Arriving at the Proper Depreciation and Valuation of Electric Light, Power, and Railway Companies and their Effect on Rate-Regulation.

Introduction.

In view of the fact that a subject such as we have chosen for investigation is out of the beaten path of design or experimental theses, we feel that a word of explanation might not be amiss. Altho not strictly technical in nature, the subjects to be treated are of vast importance not only to every business man, but also to every engineer. Someone has stated the case very plainly: "Engineering, viewed from one standpoint, consists in the application of the physical sciences, from another, in applying the laws of economics." The importance of the financial side of an engineering undertaking has been recognized more and more until now we have even "utility" engineers."

With reference to public utility engineers, the average engineer must not only know all about the engineering phase of any proposition in which he is engaged, but should also be able to calculate rates

that will yield a fair return on investment after all charges have been deducted, Because only a technical man can determine the value and life of machines, the cost of building equipment, factors affecting rates, and numerous other items entering into the value of a plant; an engineer is always consulted whenever an important valuation is to be made of a utility. Only an engineer of long experience, possessing clear judgment, professional skill, and undoubted integrity, is capable of making a correct valuation. And this is only one side of a complicated utility question.

The subject of public utility finance has been very much discussed of late. What, with the country-wide talk over the conservation of our natural resources, and the popular, or as some people call them, the "muckraking" magazines' continual exposures of corrupt practices in public utilities throughout the cities and states of our country, the public press has been true to their duty to make the people feel an interest in this extremely important subject, which affects deeply each individual. Until the present agitation, but little attention was paid to the methods used by the companies to raise funds for

extensions, to the watering of stock, or the fairness of rates, altho the public did object, (with little effect, when no commission had been established), to the high rates and poor service.

The technical press has been even more active. Every journal, and this is true particularly of those which deal with railroad and electrical subjects, contains one or more carefully written articles, dealing with public utility finance problems such as involve valuation, depreciation, or rates, for instance, or with the activities of the different commissions. Full prominence is given to these matters at every convention of engineering or political science societies, and the ablest members of these bodies have given much time and thought to these problems. Much has been written, more is being prepared. Then, in view of all this, is it not a little presumptious for two seniors in a college to attempt to treat this subject? We admit it seems so, but we shall limit ourselves to the general subject and explanation of methods used by utility commissions in their work.

Public Utility Commissions.

The public utility commission is a comparatively recent innovation. Ever since the early eighties, the state of Massachusetts has had a number of splendidly organized commissions with powers which were well-nigh absolute, the principle ones being the railroad commission, the gas and electric light commission, and the electric railway commission. These commissions have done splendid work and have had almost absolute control over the utilities and railroads operating in the state. All other commissions are, to a certain extent, copies of these famous organizations and have followed the precedents set by the pioneers in this work. Wisconsin was the second state to show its willingness for scientific regulation of public service corporations. Its commission, which is a model for efficiency and progressiveness, is really nothing but the old railroad commission with enhanced powers. In 1905 a railroad commission was appointed with regulative powers over the affairs of railroads, street-railways, express and telegraph companies, and, in 1907, its jurisdiction was extended to include also telephone mes-

sage transmission and"the production, transmission, delivery, or furnishing of heat, light, water, or power, directly or indirectly, to or for the public." Other subsequent legislation has added to the commission's powers. The case of Wisconsin is typical. Almost every state in the union has a railroad commission, and in practically every commonwealth in which a public service commission is now established, the powers of that body have been increased, so that it has jurisdiction over every sort of public utility.

As intimated above, one reason for the establishment of regulating bodies over corporations serving the public (although it might not be unprofitable, from the standpoint of the public, to intelligently regulate all large corporations) is the attitude of the public itself. The unwarranted juggling and speculating carried on with the stocks, not only causing losses to many investors, but also making the business unstable, the exhorbitant rates which were often demanded of the public, the arrogant attitude of the men who control these corporations, which is shown nowhere so concisely as in the famous, albeit somewhat vulgar, expression of one of the Goulds, "the public be damned," all contributed to the popular feel-

ing of distrust. The public demanded that they be treated fairly, both as to service and rates. And their clamor began to be heeded. The public press, particularly if opposed politically to the administration have always been active in demanding corrupt public service companies.

Progressive statesmen and economists began to give a great deal of attention to the vital question of regulating the companies whose funtions are to serve the public. The idea of scientific management was developed and applied with marvellous results. Carrying this idea into public utility management, it began to be appreciated that, for the highest effectiveness, not to speak of the most satisfactory treatement of the public, a state body, having control of a regulative nature, over all sorts of utilities, would be necessary.

However, the public must not be given indiscriminate, absolute control of all companies which serve them, for their demands would probably be such as to secure low rates, but at the cost of wrecking the companies, or at least, placing them on an unfirm basis. The investor must be protected as well as the consumer. What more logical, then, than a mediator to look after

the interests of both in an intelligent and unprejudiced manner?

Some may ask why the railroad, gas, and electric plants, water works, telephone companies, and street railways should be regulated while other corporations such as the United States Steel Corporation, or the Standard Oil Company go without regulation of any kind. The former companies ~~or~~ are quasi-public, and therefore the people have an interest in them, and a right to regulate them. One strong proof that they are quasi-public is their right to eminent domain. Then it has been established by the courts that they are common carriers. The telephone and telegraph companies have been classified by the courts as common carriers of speech and intelligence in the last few years, and hence are subject to regulation by the public. Moreover these companies operate because of the good will of the people in granting a franchise, and hence the rates should be just to all and subject to commission regulation.

All these factors, the public attitude, the scientific management idea, the necessity of justice to consumer and investor, the fact that these corporations are semi-public, contributed to the establishment of public

utility commissions. These bodies have done splendidly, new as they were, and all signs point to a greater success and a still more satisfactory state of affairs in the future, which will be an era of public utility regulation.

The states of Massachusetts, Wisconsin, New York, New Jersey, Maryland, North Carolina, Oklahoma, Vermont, Nebraska, besides the city of St. Louis, have commissions now; Illinos, Kansas, and Ohio, are taking steps toward creating such bodies in their respective territory. All this has been done in the last few years, showing the progressiveness of these states ~~of~~ in adopting this innovation in the economics of public servise bodies.

Powers of Commissions.

To understand the powers of public utility commissions, it might be well to define ~~the~~ public utility. A definition laid down by the legislature and accepted as legal in Wisconsin, is; "Every corporation, company, individual, association of individual, their lessees, trustees, or receivers, appointed by any court whatsoever, and every town, village, or city that may own, operate, manage, or control any plant or equipment or any part thereof, within the State, for the conveyance of tele-

phone messages, or for the production, transmission, delivery or furnishing of heat, light, water, or power, either directly or indirectly, to or for the public."

Since public utility commissions are state bodies, their functions and powers are defined and limited by legislation. Naturally, there is a great difference in the powers vested in the different commissions. Some serve merely as a check on the utility companies in their state, to prevent them from charging excessive rates. Others are almost absolute dictators in their domain. This is true especially in Massachusetts, where many railroads are allowed only 4.5 percent, and none more than 7 per cent,net profits. There have been numerous complaints from companies operating in that state of undue oppressions by the commissions. One official goes so far as to say: "Well, we can be glad of one thing, -- they still permit us to choose the color of our cars." Seriously, too much power should not be given a commission, for they are made up of only a few men, who hold a great responsibility and notwithstanding the fact that the standard for ability and honesty has been uniformily high, there is the possibility that the control of such a body come into the hands of prejudiced or unprincipled men. The consequences would be appalling.

For the best results it is well to invest a commission with great, but not absolute, powers, making a medium between the two cases cited above. As an example of what lies in the jurisdiction of a conservative but highly successful public service body, the New York commissions, -- there are two, one for New York City, the other for the remainder of the State, -- a list of their functions is reprinted below.

1. To prescribe the form of accounts.
2. To examine the books, records, contracts, documents.
3. To prescribe the form of report, which is presented annually by each company.
4. To investigate on its own motion the violations of the law, or orders of the commission.
5. To investigate complaints.
6. To take action on complaints, if necessary.
7. To fix rates.
8. To prescribe equipment.
9. To order repairs and improvements.
10. To prescribe the frequencey and time of trains, and cars.
11. The commission's consent is required to vali-

date:-

a. Assignments, transfers, and leases of franchises, and contracts and agreements with reference to franchises.

b. The holding of stock of one railroad corporation organized in New York by another.

12. No corporation is permited to acquire more than ten percent of the total stock issued by a street-railway organization in New York.

13. The issue of stocks, bonds, etc. is prohibited for a period longer than twelve months. The commission's consent is necessary for a longer term.

Regarding the electric and gas light corporations more particularly, the commission may prescribe a uniform method of accounts but must require annual reports containing information regarding the following items:

Capital Stock.

Bonded and other indebtedness.

Receipts and expenditures.

Names and salaries of officers.

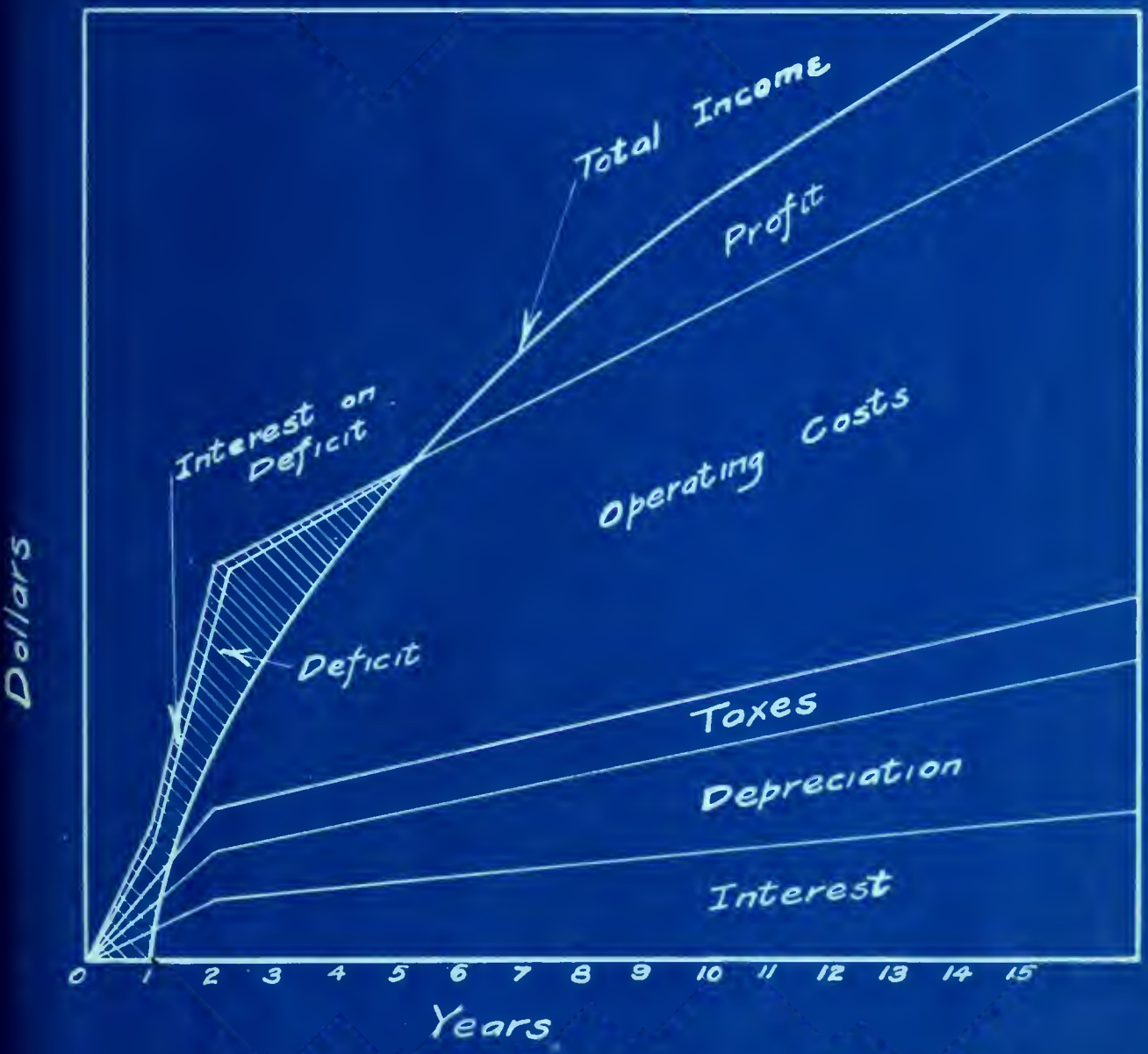
Wages paid employees.

Dividends.

Location of plants.

DIAGRAM 1.

WISCONSIN COMMISSION METHOD OF COMPUTING COST OF GOING VALUE.



(Electrical World January 26, 1911).

The commissions must also keep informed on the methods of the companies, the control of the meters, etc., Complaints are to be heard and adjusted, and especially care is to be taken as to the character of the service. Non-compliance with orders of the commission involves ~~the~~ a possible fine of $5,000 for railways, or $1,000 for gas or electric light company. The commission can compel

added service if deemed advisable,

rapid service routes being installed,

the reporting of accidents.

In the last case, it can take steps for the prevention or investigation. Surely, an extended list of functions, which places ~~the~~ a public service commission like that of New York in a position to fill a useful role in an administration of public utility affairs.

The Public Utility.

To thoroughly understand the valuations and calculations of depreciation which form the main body of this thesis, the general economics of public utilities must be understood. The accompanying curve (Diagram No. I) which was used by a writer for the Electric World of January 26, 1911, in explanation of the Wisconsin's

commission's principles, will serve well to illustrate the simple case. The public utility financial question is the same practically as that of any other commercial proposition. The chief points of difference are, - the fact that it takes much longer to get the plant into a profitable state, in the former case, and the uncertainty of the amount of earnings, depending on the caprices and fancies of the public, and their "servants", the legislatures, and council bodies. It takes a considerable time to complete an electric light plant or street railway as well as other utilities, and still more to gather customers, perfect a working force and effect an harmonious, profitable organization. During all this time, however, the interest on the capital, depreciation charges, and taxes, go on from the very first and have to be met out of the earnings of the company, or the capital stock. Not only that; there ~~is the in-~~ is the interest on the deficit, and the latter is seldom wiped out in the case of a utility before the fifth year. It can, therefore, be appreciated that this sort of an investment would be somewhat hazardous if there were not a guarantee not only of non-interference (given by franchise) but also the right to fix rates such that a reasonable profit will result after the fixed and op-

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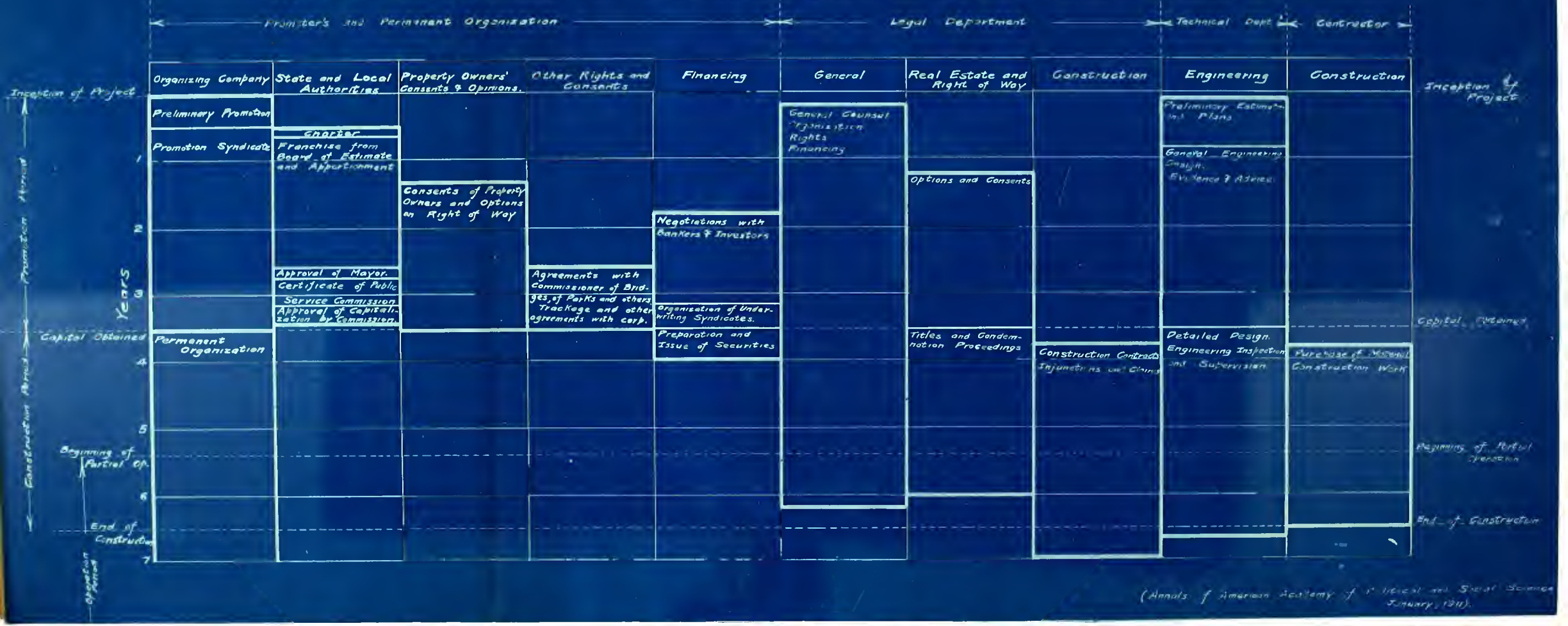
DIAGRAM 2.

CHART OF ESTIMATED TIME OF REPRODUCTION— CONEY ISLAND & BROOKLYN R.R. SYSTEM.



(Annals of American Academy of Political and Social Science January, 1911).

erative charges have been paid.

By refering to Diagram II, we can obtain a more detailed impression of the different elements which enter into the establishment of a utility as an operative, or as it is frequently called, a "going" concern. The time element, especially, is clearly brought out in the chart, which is self-explanatory.

The three most important elements of the public utility question, viz,, the value of the plant, the fixing of the depreciation rates, and the regulation of rates, are to be treated in detail, as far as possible, in this thesis.

Valuation.

Introductory.

The first question we shall consider is that of valuation. The public utility commission, to fulfill its functions, especially those of rate making, determining company taxes, and consenting to bond issues, must first have an up-to-date, and accurate valuation of the utility. As all that is included in the valuation for tax-making, and bond-issuing purposes, is included in the valuation for rate-making purposes, we will only take up the valuation of a utility for the work of rate making. Before the commissions were established the valuations of utilities depended altogether upon the judgment of the management -- honest or otherwise. Some still think the value of a utility should be based on the earning capacity of a company. If this is the correct method, the question arises as to what will determine the rate in the first place. The answer might be, "What the traffic will stand." However, the courts have decided that the investors are entitled to a fair rate of interest only on the actual money invested. This appears just, when we consider that there is no

great risks connected with the utilities, for the commissions raise the rates if necessary to a point where there will be a fair return upon the investment. The policy of the commissions has been; "Give the public the lowest possible rate, and yet protect the investors." This means that the commission will order new and efficient machinery if the present is inadequate, will not allow competition if it endangers the existing companies' capital, will raise rates if necessary, but never will lose sight of the necessity of giving to the public the best service possible for the least money. Often the management have a fluctuating capital in order to manipulate the sales of stocks, but always to their advantage. Other times, they do not care, or do not know how to find the real value of the plant. There are very few instances where the rated value and the actual value, based upon the cost to reproduce new in the present condition of the plant, as found by the commission, agree. Where the commission allows the company to make a fair return upon the value as determined by them, it might seem they were taking property away from the utility without due process of law, but this is not the case, for they go over the plant very carefully to find just what it did cost.

Methods used by Commissions.

The commissions as yet have no set ways of determining the value of a utility. However, there are some fairly well established methods applicable. In a few cases where the books are kept correctly, the commission can obtain much of its information for the valuation from them. One general method used as exemplified by the Wisconsin Commission consists of the following: First, the representatives of the Commission have a conference with the officers, which, in most cases has resulted, in both an understanding and good-feeling between them. In most cases the inventory is obtained from responsible officers of the utility. If no inventory is available, the commission's men go over the books and records of the company, making a tentative list to use in checking up when out on the field. With either the inventory or the list, the engineers check up each item, and also make a note of any missing pieces. A full description of each part of the equipment is obtained, This includes a comprehensive description in its original or new condition; whether new or second-hand when installed for the present service; if reconstructed, extent and reasons for reconstruction; date of installation and reconstruction, if any; whether in-

termittent, continuous, moderate, or severe service is rendered; whether quantity and quality of maintainence is good, fair, or poor; and any other information which will have a bearing upon the final or operating value.

The staff then fixes values to each unit regardless of the use to which it is put, based upon standard unit prices. They are extremely free from bias. To determine the correct unit prices, the commission's staff consults the companies' records, specifications, contractors' contracts, prices furnished by manufacturers, and information from engineering experts as found in technical journals, in societies and their proceedings, and the sworn testimony of experts, and the commission and court cases. When it is advisable to overcome extreme fluctuations in the market values, average prices for five years before the date of valuation are considered fair. In each case, an effort is made to considerall local conditions. Then all this is made into a "tentative report" and presented to the company's engineers, who are allowed to revise, correct, and add to it, forming a suplement to the report. Often this report is prepared by experts who are called in by the company. In looking over the reports of the Wisconsin

Commission, one is impressed with the thoroughness of their valuations. After these steps have been carried out, the Commission determines what allowances should be made for depreciation. Naturally, depreciation is based only on depreciable property. Hence scrap value must be deducted before fixing the amount of depreciation. Scrap value is defined as the price that can be obtained after all expenses, such as dismantling and removing the machinery, cost of delivery to the market, and the like, have been deducted.

Having determined the various elements entering into valuation, it is possible to calculate the present value of the utility. This is calculated by the generally accepted formula which states that the present value equals the remaining service value, plus the scrap value , or in other words, equals the scrap value plus the depreciated service value.

To simplify the report, the detailed valuations are summed into groups. The Commission has worked out a set of schemes for the different classes of utilities, which makes comparison between the different companies of the same class more easy.

As an example of the Wisconsin Commission's method, a brief summing up of their work on the Milwaukee

Electric Light and Railway Company's property is given below. The entire equipment is classified into groups, and examination, inventory, and the cost to reproduce new are determined for each item.

Group 1 Land (right of way and other real estate).

2 Track and track structure.

3. Cars and car equipment.

4. Electric distribution system.

5. Power plant equipment.

6. Buildings and miscellaneous structures.

7. Office furniture and supplies.

8. Tools, implements, and machines.

9. Horses, wagons, and miscellaneous items.

10. Addition of a percentage to cover engineering supervision, interest during construction, contingencies, and the like.

11. Storage and supplies.

12. Paving.

This property had a value of $18,435,960.00 when new, and $14,864,849.00 at the time of valuation.

The steps in the valuation were:

1. Preparation of detailed inventory.

2. Field examination of property by a trained staff.

3. Determination of the"cost new" of each item.

4. Estimation of depreciation on each item of the property.

5. Calculation of the present value.

6. Summing up the detailed value by groups.

When a bond issue is under consideration, pending completion of a formal valuation, or when a municipality wishes to purchase a utility, only an approximate valuation is made.

Going Value.

A much disputed point in the valuation of a utility is the prominence given to going value. This is a very important factor and often the deciding one in rate making, and therefore we shall interrupt our description of methods of arriving at the physical valuation of the plants by giving it a thorough investigation. There are two definitions for going value; one from the cost, the other from the value standpoint. From the value standpoint, the going value equals the total value of the utility; from the business standpoint, what a buyer would be willing to pay for the business less the physical value. Taking the cost view, considering either

first cost or reproduction cost, the going value equals the cost of acquiring the capital, rights to conduct the business, and the tangible property plus the cost of placing the company in a paying position.

The value of ~~the~~ a plant is really based upon earning power, when considered from the value standpoint. If a company gives good service, which is satisfactory to the customers, and besides pays fair dividends, the buyer is willing to pay for even the watered stock; that is to say, the investor wants a fair or good dividend upon the money invested. He is not particularly interested in the actual value of the plant, odd as it may seem. However, he insists on a large profit before investing in a plant that is in poor repute with the public.

It is easy to see why the Commissions will not allow the utilities to capitalize on the above sort of going value. In the first place, they try to make rates that will pay a fair rate upon the actual value (money invested) of the plant and secondly, compel them to give good service, which will, except in extreme cases, give ~~them~~ a good standing with the public.

The New York, Wisconsin, and Massachusetts, as well as most of the other, commissions, do not allow any thing for ~~the~~ franchises unless the utilities have paid money to the city for it. In New York capitalization of franchises is prohibited by law.

One important commission made the ruling that a utility's monopoly privilege cannot be considered of value for rate making purposes. Since they will not allow a second company in the same business, unless the older one cannot make arrangements to care for the business, their action is evident. This commission does not usually consider extra land near the plant to be worth more than surrounding land, although it is recognized that it does have extra value in some instances. The commissions consider special patents, leases, privileges, and the like in about the same light.

To make this plain we will cite a case from the Wisconsin Commission.

> The commission says in part: "Investigation of the facts involved makes it quite obvious that justice between the investors on the one hand, and the consumers on the other, require that, in valuing public utilities, consideration should be given to the amounts expended by the former in building up the business.

This is especially true when the earnings of a utility have not been sufficient to meet reasonable expenditures for development of the business and to cover operating expenses, depreciation, and reasonable returns on the investment. When losses incurred in building up a business are due to such delays in securing the required amount of business as cannot be reasonably avoided and have not been covered by subsequent surplus earnings, it is difficult to escape the conclusion that they must also be regarded as one of the elements that should be considered in appraising the plants, and in fixing their rates. By this it is not meant, that deficits from operationcan equitably be taken into account when such deficits are due to abnormal conditions, such as bad management, extravagance, unduely high capital charges, etc. Nor can a purely arbitrary value be considered a going value; whether or not a plant is entitled to a going value depends entirely upon the condition in each particular case.

After careful consideration of the financial condition of the company, the Commission concludes that its plant has no going value over and above

the cost of reproducing these plants new. The method of arriving at the above conclusion was as follows: The cost of the plants at the time they were acquired by the respondent was ascertained as closely as possible. This cost, together with the amount expended for new extensions, increases in land value, depreciation, and interest and profit on investment, were charged up against the plant for the first year, while the plants were credited with the net earnings for the year. The balance then indicated, the value of the plant, at the end of the first year, for an assumed reasonable interest on the investment. This plant value was then used for the next year's calculations. The same operation was repeated each year from 1896, when the plant was acquired, until 1908. The values of the electric plant as determined in this way are shown below for the last three years:

	1906	1907	1908
Value of plant	$369,698	$380,296	$453,768
Additions to depreciable property	13,138	81,705	13,887
Increase in land value	1,620	1,620	-----
Depreciation	20,605	21,281	25,482
Interest at 8%	29,576	30,424	36,301
	$434,637	$515,328	$529,438
Net earnings	54,341	61,560	78,987
Value of plant at end of year	$380,296	$453,768	$450,451

In these calculations, depreciation in real estate is recognized. Depreciation was figured on depreciable property only, at a rate of 5.57 per cent on a straight line basis.

At the end of a period the value of the electric plant computed in this way on an 8 per cent working basis was $450,451, as against the commission's valuation of $535,000. Consequently, the plant has been earning more than reasonable returns on the investment, and therefore, has no going value. The cost of reproduction now represents the maximum value that should be placed upon the plant for rate making purposes."

The case referred to is that of the State Journal Printing Company, vs. The Madison Gas and Electric Co. (Wis. Com. Report, U-58).

From this we see the commission does not allow anything for the fact that the management used good judgment in conducting the plant.

However, every utility must have money on hand and in the bank to carry on the business, bills and accounts receivable, storeroom and stock supplies, on all of which they are entitled to a fair rate of interest.

In the above case, this amounted to ten per cent.of the plant value. In a large plant it would not amount to as large a percentage, while with a smaller plant, it would require a greater percentage. The reason for this is that a large company has a much better credit, and can secure any additional money upon short notice without paying a high rate of interest.

Besides, taking into account this liquid capital, the cost of putting a business on a paying basis must be considered, and it is considered by the commission. As stated before, it takes several years to construct a plant, and even after being placed on an operating basis it often does not pay expenses, let alone dividends. In most of the cases before the commission, the companies have chosen an arbitrary percentage of the physical value of building the plant, but have not, in most cases, been able to support it. As seen from the above example, the commission looks over the books and the conditions surrounding the plant, and if the company has not been amply paid for the losses, they will allow a value for the estimated loss of the company in building up the business.

We see there is a wide difference in the methods pursued by different commissions, officers, and expetts

called in by the management, and the results they lead to. Not only that, but when a plant is being valued for taxation, these same officers fix the going value as well as the physical valuation at a low figure. It will probably be several years before any standard methods will come into general use.

The Methods used by Commissions.

It might be interesting to look over an outline of the list of objects that enter into tangible and intangible valuation of a plant as seen by the utilities. The following outline of tangible property of a utility is given by Frank R. Ford.

I. Company's overhead charges upon construction.

1. Executive organization work and expenses.
    a. Accounting expenses.
    b. Office expenses.
    c. Store room and stable expenses.
    d. Permits of authorities and city inspection.
2. Legal work and expenses.
3. Technical work and expenses.
    a. Company's engineering organization.
    b. Consulting engineer.
    c. Architects.
    d. Testing and outside inspection.

4. Interest during construction.

5. Taxes during construction.

6. Wear and tear during construction.

II. Land (including private right of way and sights for car-barns, shops, terminals, and power-house.)

1. Assessed value.

2. Additional market value for ordinary purposes.

3. Additonal market value for railroad purposes, including,

   a. Plottage.

   b. Contiguity Factor.

   c. Special Value for railroad purposes due to location.

4. Charges for acquisition of land, such as

   a. Brokerage

   b. Legal work and expenses.

   c. Technical work and expenses.

   d. Title insurance.

   e. Loss on portion of land not necessary for the carrying on of business.

   f. Loss on buildings discarded.

III. General Contractors' profits and overhead Charges.

1. Work and expenses of contractors' general organization and office expenses.

2. General superintendence, watching, and lights.

3. Fire, accidental, and liability insurance during construction.

4. Maintenance and use of tools.

5. General contractors' profits.

IV. Material and labor, comprising the physical construction and equipment, as furnished by the sub-contractor.

1. Inventory, priced on the basis of sub-contracts.

2. Extras, incidentals, and contingencies.

V. Stock, tools, and supplies .

1. Inventory, based on the basis of standard price lists.

2. Incidentals.

VI. Working capital, including,

1. Cash on hand.

2. Accounts and bills receivable.

3. Prepaid accounts.

4. Lands and buildings not used in operation.

All the remainder should be considered as intangible property.

The following list is considered from the cost standpoint:

Work and expense items through the development period of a street railway.

I. Promotion.

1. Work and expense of promotor's organization.

2. Preliminary legal work and expenses.

3. Preliminary technical work and expenses.

a. Survey and location of lines.

b. Estimation of construction cost, of income, and of expenses.

c. Preparation of prospects.

4. Profits of promotion.

II. Corporate organization.

1. Legal work and expenses.

a. Incorporation.

b. Details of perfecting legal organization.

c. Form of securities.

d. Mortgages.

2. Executive organization's work and expenses.

a. Directors' offices, and employee's work and expenses (Initial construction started).

b. Engraving securities.

c. Registration and certification of securities.

III. Franchises and consents (often under conditions of competition)

1. Property owners' options and consents (location and motive power)

a. Legal work and expenses. (Vacations due to injunctions)

b. Technical work and expenses.

c. Payments for franchises.

x. Lump sum.

y. Capital expenditures under governmental requirements for property, the title of which does not belong to the company, such as:

Grading and Widening streets.
Removing sub-surface obstructions.
Paving.
Change of location of track line, due to governmental requirements.

2. Consent of State's utility's commission.

a. Executive office's work and expenses of present project.

b. Legal work and expenses.

c. Technical work and expenses.

IV. Development of technical standards.

1. Past supersession and obsolescence, caused by,

a. Changes in art.

A. Stage coaches
B. Horse car systems.
C. Cable systems.
D. Storage battery system.
E. Compressed air system.
F. Underground contact system.
G. Gasoline system.

b. Improvement in the art.

A. Large double track.
B. Introduction of prepayment and safty devices.
C. Improved electric cars.
D. Improved grades and alignment of track.
E. Standardization of gauge.
F. Replacement of single by double track.
G. Heavy rails of improved design.
H. Improved paving and foundations.
I. Steel poles.
J. Wires under ground.
K. Fireproofing barns, shops, and power-houses.
L. Replacing belted engines by turbines, etc.
M. Alternating current distribution.

2. Piecemeal construction.

3. Extra cost of construction, due to no interference with operation.

4. Solidification of road-bed.

5. Adaptation of construction equipment.

V. Development of company's business.

1. Losses of early operation.

2. Losses of out-lying sections.

3. Perfection of executive organization and business methods.

4. Development of park and amusement enterprizes.

VI. Consolidation with and control of other companies.

1. Cooperative consolidation.

a. Executive organization and expenses.

b. Legal work.

c. Payment to State or city.

d. Payments for securities.

e. Tangible or intangible value of merged corporation.

2. Leases of other corporations.

a. Executive organization work and expenses.

b. Legal Work.

c. Payment to city or State.

3. Investment in securities of other corporations.

VII. Financing.

1. Work and expenses of promotors and associates in negotiations and underwriting.

a. Preliminary promotion of syndicate or association.

b. Stock underwriting syndicate.

c. Bond underwriting syndicate.

2. Sale of securities.

a. Permission for issuing from state commission or municiple authority.

A. Executive organization and expenses.
B. Legal work and expenses.
C. Technical work and expenses.

b. Financial negotiations.

A. Executive organization and expenses.
B. Legal work and expenses.
C. Technical work and expenses

c. Payment of commission to bankers and brokers representing their work and expenses in profits.

d. Discounts on securities.

VIII. Patents and licenees.

1. Development of Inventions.

2. Purchase of plants licenses.

IX. Interest on work and expenses, items of intangible property until the commencement of operations.

A chart showing the above will be found on page 37. The classification given above is very comprehensive. The commissions treat many of the items in a much different way and their reasons are

either apparent or logically explained.

As explained before, they take an inventory of the plant, placing a value as if reproduced new in the same form as found. This inventory includes all office furniture, store supplies and the like, and hence they are not considered as a separate part except in the summary. The commissions have been in the habit of allowing all the way from 2% to 15% for organization and legal expenses. Where the company becomes involved in law suits, this item will be a much higher percentage of the total cost. The commissions always review the history of the company before allowing ~~the~~ any percentage ~~of~~ for this particular company. Items III, IV, V, VI, have been touched upon before.

In a few cases some of the commissions take the sub-contractor's prices and add ten percent or some such value for the general contractor's profit, but this is not favored by the Massachussetts, New York, and Wisconsin commissions. They figure upon the engineering cost in most cases. The usual percentages range from five percent to twelve percent. As seen by Diagram I, the taxes, insurance, interest

and the like amount to considerable. The commissions either figure the cost or get it from the companies' books.

In most cases the value of the land appreciates. The companies are given credit for the increase. Often there is a controversy over the present value of the land, which is settled by finding the prices at which similarly situated land is actually selling. The commissions will not consider the prices named in offers. Where the land has trackage and other facilities, the commissions allow extra value, provided there is an increase in the value due to these. If the buildings have to be removed, they would allow for them, but in most cases, where there is no record of any buildings having been removed, no allowance for removals is made. The commissions figure that the companies have been making ample returns, and as a rule do not allow for all the details named; but if the company has not been making fair dividends, which has happened in a few cases, with some of the smaller plants, all the above details are more carefully considered.

The commissions are not inclined to consider promotion expenses, although they recognize the fact

that considerable money is spent in this manner. The corporate organization is not considered again under this head by the commission.

As stated before, the franchises are never capitalized unless money was paid to the state for them.

The development of the company's business is always carefully considered and this is considered as a legitimate charge against capitalization in the majority of cases. However, if the company has been making dividends high enough to wipe out this debt, they will not allow it to be charged to the capital. The commissions will not allow anything for monopoly privileges or the consolidation of other companies. Leases and patents are usually not believed to have ~~the~~ any value for rate making purposes.

In some cases, a small percentage is allowed for the selling of bonds and ~~a~~ discounts. The commissions believe that the changes due to the development of standards and the improvements in the art should be charged to depreciation. They only consider the machinery in use or held in readiness at full value less the depreciated value. Machinery that has been taken out of use is figured at junk or scrap prices.

Piecemeal cost is generally adjusted by fixing the cost per unit for the various elements. Likewise, extra cost of construction due to the necessity of non-interference with the operations may be fixed.

If extentions are necessary, the commissions are unanimous in insisting that they are to be capitalized, instead of paying for them out of the pperating expenses. The justice of this ruling is apparent. The following example will show how one case was treated by the N. Y. Commission of the First District for the Coney Island and Brooklyn Railroad.

This property was examined to determine:

1. First cost.
2. Cost to reproduce, physical property, (not including real estate).
3. Present value, including the depreciated value of the physical property plus the value of the real estate and right of way, and the current asset i.e., Cash on Hand, Shares, Special Reserve Funds, etc.
4. Development expenses, including Legal, Technical, Financial, and Permanent Way Development Expenses, and Working Capital.
5. Needed Improvements.

1. FIRST COST: Upon examination of the records it was found that after an authentic information as to th the original cost of all parts of the property could not be secured. The present property is made up of the consolidation of several small street-railroads, and the present set of books does not show the details of the original charges. Much valuable information, however, was gained by examing the records and vouchers of expenditures during the past few years, and in many cases the costs shown were checked and used in obtaining the cost to reproduce.

2. COST TO REPRODUCE: PHYSICAL EQUIPMENT: To arrive at this value, the following process was followed:

A. A careful itemized inventory was made of the entire tangible property, (exclusive of real estate).

B. A unit cost was determined for each item to cover the cost of labor and material, "as of today", i.e. --- the date of appraisal.

C. Each unit price included in the estimate was made on the basis of a sub-contract.

D. Percentages were add d to these estmates as follows:

a. Contractor's profit , 10% on all items of a construction nature, as follows: Track, Track special work,

bonding, overhead trolley construction, overhead feeders, underground conduit, and cables, power plants, sub-stations and buildings. This allowance encludes general contractors overhead charges.

b. Incidentals, organization of engineers, fifteen percent, as an additional percentage on the all above construction items, and also upon the rolling stock. The above fifteen percent may be considered to be divided into three parts as follows:

Incidentals, including contingencies, complete inventory, and loss and wastage of material during construction.

A. Company's administration expense, including rent, officer's salaries, state and city permits and fees, property owners and local consents, legal expenses in connection with construction, superintendence and inspection, accounting department, printing, store-room expenses, etc.

Engineering, including cost of design and testing of all construction and equipment items.

3. PRESENT VALUE: This value was divided as follows:

A. Depreciated value of physical equipment.

B. Value of real estate and rights-of-way.

C. Current Assets --- such as furniture, supplies, tools, scrap, cash on hand, reserve, account, etc.

A. Depreciated Value of Physical Equipment:- This value was obtained under the following instructions: Deduct from the cost to reproduce the depreciation which may have been caused by obsolescence, inadequacy, wear, deferred maintainance, and casualties.

This equipment can deteriate only down to its scrap value. In obtaining the present value of this part of the property, therefore, consideration should be given to the following items:-

A. Cost to reproduce, including: Contractor's profit.
Incidentals.
Administration during construction and engineering.

B. Scrap Value.
C. Original Service Value.
D. Depreciation due to obsolescence, inadequacy and age.
E. Depreciation due to normal wear.
F. Depreciation to deferred maintainance and casualties.
G. Remaining service value.
H. Present value, as follows:-

$$C = A - B.$$

$$G = C - (D + E + F)$$

$$H = G + B.$$

B. Scrap Value: is determined by allowing a fair market price for the material as scrap, less the cost of turning it over to the dealer.

C. Original Service Value: is the difference be-

tween the cost to reproduce (A) and the Scrap Value (B). Depreciation was considered as taking place only on the Original Service Value. Scrap Value does not depreciate.

D. Obsolescence, Inadequacy, and Age: There is a class of depreciation which cannot be prevented by maintenance, or offset by repair. Obsolescence which results from a "change in the art", inadequacy, due to the growth of the business and the natural result of age, are the examples of depreciation which can only be taken care of by replacement, and should therefore be provided for by means of a renewal, reserve, or amortization fund.

This fund should equal the Original Service Value of the part by the time it becomes of no operating value. If the amount that should be in this reserve fund at any time is determined, then this amount is the proper measure of the depreciation due to the above causes, which have occured up to that time.

There are a number of possible methods which may be followed in determining the amount which should be annually allowed for a reserve or amortization fund, for each part of the property which is subject to obsolescence, inadequacy, and age --- but for the

purposes of this appraisal, the simplest and most direct method has been adopted. This method consist in deciding upon a probable time when each part of the property shall be of no operating value; that is, reduced to scrap. Dividing 100 by this length of life in years gives at once the annual percentage or rate per year of depreciation from these causes. The product of this rate, the elapsed life of the part, and the original service value, equals deduction to be made for obsolescence, inadequacy, and age. If a reserve fund has not been provided to offset this depreciation, then a deduction of the amount should be made from the cost to reproduce when determining present value.

E. Normal Wear:- the normal wear of any part is the deteriation of that part due to service or action of elements, and should periodically be offset by proper and regular maintainance and repair. This wear may be considered as "Normal", down to the point where economy of operation or adequate service dictates repair -- if allowed for any reason to wear --- beyond this point, continued wear means neglect or deferred maintainance. A depreciated condition of the service as a whole, however, must ordinarily exist from normal

wear, due to the fact that wear on the system as a whole, which occurs gradually, can, as a rule, be offset only periodically, and there will be an appreciable time between the actual wear and the renewal of its effect from the system.

The measure of this normal wear is best determined by a careful, detailed examination of the property --- but as it is often impracticable to make such an examination over an entire system in such a short time that the wear neither increases nor is removed during examination, it is ordinarily more practicable and equally as accurate to determine this normal wear as follows: --

For all parts which have been in use long enough to have passed through an entire period or cycle of complete repair -- determine the entire cost of one complete maintenance, i.e., the cost of a complete renewal of those parts subject to wear. The amount to be deducted for normal wear is fifty per cent of this total maintenance cost, as the average condition of all the parts is midway between the point of complete repair and normal dispepair. Whether or not this normal wear, which is inherent, should be offset by a reserve account, is an undecided question; but in examining a property the amount of this normal wear should be determined.

F. Deferred Maintenance and Casualties:--

If proper and regular renewals have been neglected from any cause, the amount of such deferred maintenance should be determined and this amount deducted when arriving at"present value". If the buildings or equipments have been subjected to a fire, severe collision or other casualties, entailing a loss which is not chargable to regular maintenance, then the amount of such loss should be determined and a proper reduction should be made. If a reserve account is available to offset all or any losses, then the amount of such fund will appear as a separate item to be added to"present value".

G. The Remaining Service Value: -- is found by subtracting from the original service value the sum of all depreciation due to obsolescence, inadequacy, age, neglect,and casualties.

H. The Present Value:-- of the Physical Equipment is equal to Remaining Service Value, plus Scrap Value.

As a general proposition the public utility commissions are willing to allow for all expenditures if the company has not been amply paid for them. We also notice there are some general methods in use but that each valuation has to be treated individually.

DEPRECIATION

Definition of Terms.

After the value of a plant has been determined and knowing the operating expenses, the commission can determine the rates to be charged in order for the investors to earn a fair return upon the investment, but to hold the plant up to its present value, a certain amount has to be set aside each year to pay for the machinery when worn out, and this must be taken out of the money paid in by the customers. In a great many companies this additional rate is not placed in a reserve fund, but given to the stockholders as dividends, with the result that at the end of a term of years the company has worn out and outgrown their equipment, and have no money with which to buy more. New capital is raised and the plant started out again. But the stockholders at the time of reorganization are losers. However, the stockholders are not the only losers, for when the equipment is nearly worn out, very poor service and often an increase in the rates results. Probably the most noted case is that of the Third Avenue Railway of New York. This company fell into the hands of a receiver three times in ten years. The cars were filthy, and slow, because of break-

downs, amd the New Yorkers would not let one car pass for fear another one would not come along. The reason for this state of affairs is that the company aimed to pay large dividends, but did not keep up the plant by setting aside something for depreciation. The public did not pay much if any attention, to it, and the engineers but little, but just now this question is receiving much attention from both. The wise investor determines how much is allowed for depreciation, and, if it is ample, before he invests in any concern. Depreciation in general is the amount which has to be set aside each year to hold the value of the plant constant. In a way it can be considered as a life insurance -- for full value, -- upon each item in the plant. The minor repairs are spoken of as maintenance of the plant, while the large and extraordinary repairs are met out of a depreciation fund.

The dividing line between maintenance and depreciation, is not at all well established, nor are the rules of depreciation fixed. Among the men who are in position and are supposed to know much about depreciation, one says it is a mere matter of bookkeeping, another says it should be determined by the

directors (he probably has in mind the unprofitable state of his company) and another thinks it is not right to charge the present customers for improvements in order that the later customers shall receive improved service due to the changing or overhauling of the present equipment. No matter what they do think; we know depreciation is one of the most important financial questions involved in the practical operation of public utilities, or any other business of some such nature. A man would not invest his money in any concern if he knew he was to receive only a fair rate of interest upon invested money, and, at the end of say ten years he would lose all, the plant being worn out. The utility must be safe as well as a profitable investment before people are willing to put their money into it, and if the capital cannot be raised, we will have to do without the utility. Several years ago the utilities had no trouble to raise any amount of money, but because of their enticing people to invest by the apparently high dividends, but at the expense of the plant wearing out, they are now experiencing some difficulty in raising any capital.

There is some truth in the statement that the difference between depreciation and maintenance is a matter of bookkeeping. One able man states that maintainance holds up the plant while depreciation protects the investment. A storage battery firm claims there is not depreciation upon the batteries, but only the maintainance. They say the plates have to be replaced, the acid renewed, and the cases repaired, all of which is maintainance. This may be true, but it is generally accepted that a storage battery will last about fifteen years, and therefore the depreciation will be six and two-thirds per cent.

However, the storage battery case is special. With most equipment , an increase in its capacity can only be accomplished by adding more units or replacing the present with larger units. With the storage battery, the capacity is increased by merely adding more cells. Also the development of the storage battery has remained nearly constant until the invention of the Edison cell. With almost all other equipment there has been decided improvements on account of the progress in the art. Often these improvements make such decreases in the oper-

ation costs or cause such demands from the public that the present equipment which really is far from worn out, must be replaced by newer. The above classes of depreciation are known as inadequacy and obsolesence.

A good example of inadequacy is found in one of the substations of the North Shore Electric Company. This station was thought to meet all requirements for a great number of years, but during the first year the available space saved for another unit was filled up and at the end of a second year it was found necessary to erect a new building and put in larger units. The depreciation of this station, if nothing would have been realized from its scrap value of the machinery, would have been fifty per cent. This is of course an extreme case. A very common instance of great depreciation is found in telephone switch - boards. These must be replaced by newer ones about every eight years, because of their inability to handle the business and the demands of the subscribers for newer equipment.

Other examples of depreciation due to obsolescence besides the one cited about switch boards, becoming old fashioned as it were, are found in the development of

street car systems, from horse cars, to cable cars, later to the single truck electric cars, and finally to the double truck cars. Other steps in the progress in the art are, the changes from belted engines and generators to direct connected units and later to turbo-generators, and also the changing from the direct current to the alternating current distribution systems. Since these changes are gradual, the facts are not appreciated that the present equipment is depreciating from this cause and will have to be replaced before worn out.

For this reason, depreciation due to wear and tear is not always as important as it would seem. However, it must be considered. Minor repairs are charged to maintenance. Only when some expensive part has to be replaced, or some large part is broken, is the depreciation account charged. Some companies charge any repairs under three hundred dollars to maintenance and those above to depreciation. The damage caused by so-called "Acts of God," fire, and the like, must be made good out of the depreciation fund.

Rates of Depreciation.

The rate of depreciation to charge against the different items of a company's property, depends upon all these factors, inadequacy, obsolescence, and wear and tear. The rate of depreciation may be defined as the percentage of the value of the item that has to be set aside each year based upon its useful life; that will hold the investment in-tact and constant. There are some life tables for each piece of machinery that show its average life under some of the different conditions of operation. Of course, all conditions cannot be tabulated in the tables even if they were known. The commissions have spent much time in making new ones and revising old ones.

The list below gives an idea of the life of the different parts of equipment for a plant:

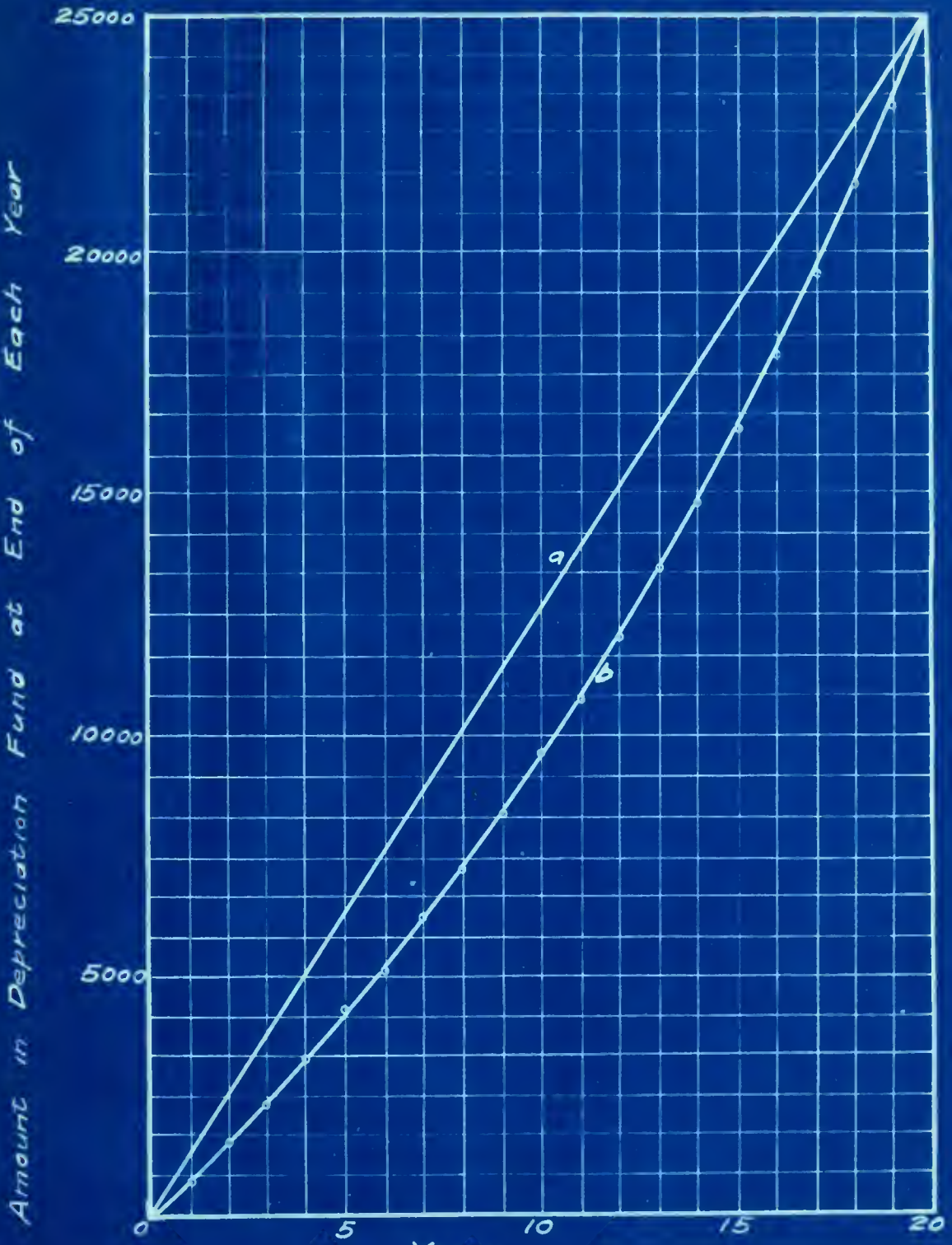
	Scrap Value%	Life Wears	Depreciation Rate	% Rate 1st Yr.
Station equipment	15	10	10	8.5
Pole lines	0	10	10	10.
Wire and Circuits.	25	10	10	7.5
Street lamps,	10	5	20	18.
Transformers	10	8	12.5	11.25
Converters	20	20	5	5
Meters	10	10	10	9

Methods of allowing for Depreciation.

The next question arising is that of determining the method of allowing for depreciation. There two methods in general use. One the straight line , the other the sinking fund.

The straight-line method is easier to calculate. For instance, take the synchronous converters in a substation of 3500 K.W. capacity. They will cost about $25,000 and the life is estimated at about twenty-five years, If the depreciation is not allowed to earn interest, $1,250 must be laid aside each year in order that at the end of twenty-years, when the converter is worn out, $25,000 will be on hand to buy a new one. Now, if the depreciation of the sub-station machinery mentioned above were to be determined upon the sinking-fund basis, only $755.00 would have to be set aside each year. If we assume an interest of five per cent for the sinking-fund, we would have $755.00 plus five per cent of $755.00 or $792.50 credited to the fund at the end of the first. The interest of the next year would be computed on the basis of $792.50 on the compound interest plan. Therefore at the end of the second year it would be $792.50 plus five percent, plus the yearly deposit of $755.00 making a total of $1587.39 . Following this plan of

STRAIGHT LINE AND SINKING FUND METHODS FOR ACCOUNTING FOR DEPRECIATION



Apparatus worth $25000 to be redeemed.

a. Straight Line. b. Sinking Fund at 5 per cent Interest.

Estimated Life — 20 Years.

procedure, the $25,000 which is to be redeemed will have been accumulated from a yearly deposit of $755.00 at the end of the twentieth year. The values of the depreciation fund at the end of each year for both these methods of proceudres are given belpw:

	Amount in Fund at end of each Year.	
Year	Sinking Fund Method	Straight Line Method.
1	792.75	1250
2	1587.39	2500
3	2421.76	3750
4	3297.85	5000
5	4217.74	6250
6	5783.63	7500
7	6197.81	8750
8	7262.70	10000
9	8380.84	11250
10	9554.88	12500
11	10787.62	13750
12	12082.00	15000
13	13441.00	16250
14	14868.57	17500
15	16366.57	18750
16	17939.90	20000
17	19591.90	21250
18	21326.49	22500
19	23147.81	23750
20	25000.00	25000

A study of these figures will show that there is quite a saving in the annual contribution to the depreciation fund if the sinking fund method is followed instead of the straight line method. These figures, which are merely a special application of the general principle, are visualized in the accompaning curve.

The annual saving is made quite apparent by one glance at the curve.

From this it is seen that the curve line method or sinking fund method is the preferable one in every instance on account of the direct saving in money laid aside, but it has some serious disadvantages. Some of these we shall now enumerate.

In the first place, if a piece of apparatus is to be accounted for, by a depreciation fund has a small value, or its life is short, there is no great advantage in using a sinking fund, because the interest is only small at the beginning, even for an expensive piece of apparatus.

Another objection is this: if, for some reason or other, a large repair must be made on a piece of apparatus, or if it must be replaced before the time of expiration of its estimated life, the total cost will not be redeemed, because the amount to be gained by compound interest for the unexpired term of years, for the estimated life will be lost. If it is especially the latter years of the term by which the interest is compounded, which are most productive in adding money to the fund. Hence, there is a much greater actual loss incurred when the sinking fund method of accounting for depreciation is used, than if the straight line

system is applied.

The most serious fault to be found with the curved line method is the fact that the money in the depreciation fund is tied up, and in case of a sudden demand for cash caused by some unforeseen circumstances it is inaccessible. This is particularly objectionable in the case of utilities which have a short life and the nature of which necessitate frequent changes. These companies must have a ready supply of cash, therefore the curved line method would be unsatisfactory for them to use in providing for depreciation. This would hold true, for instance, for electric light, railway, and telephone companies; on the other hand few changes are necessary in a gas plant, for example, and for this reason the sinking fund method is the proper one to be applied to them.

Methods used in Determining Depreciation of Plant as a Whole.

Having studied the different methods which can be used in fixing the depreciation rate for any piece of apparatus, we can now take up the two methods pursued in determining the amount to be set aside each year for the whole plant.

Where the direct method is used, the life of the various parts is determined, as well as its cost. Of course, the scrap value is deducted. Then this term of years is divided into the longest life of the list of items. This gives the number of times renewed in a certain period of years. This number multiplied by the value gives the dollar years for this particular piece. In the same manner the dollar years are calculated for the other items. The dollar years divided by the dollars required during the "certain period" gives the average life of the plant.

The plan used for the sinking fund method is widely different from that used above. First, the interest rate must be determined, usually by consulting a banker. By the so-called "compound-interest sinking fund" the separate parts of the property are classified according to their years of life, and a sinking fund payment at a prescribed rate of interest calculated for the class. The total figure gives the amount to be set aside each year and the average life is the time required to accumulate the value of the plant by setting aside this required amount.

"In the scheme which I have suggested.....
.....each part is treated separately, and at the end

of the life of each part, a sufficient amount has accumulated for the renewal and again this part of the annual payment to the sinking fund goes on accumulating to pay for the next renewal on the part concerned. ..

"While for convenience of statement and to facilitate convenient comparison with other class of depreciation, we may calculate out the average per cent of the total value of the plant, to be laid aside each year,.. .....still we must not forget this total is made up of absolutely distinct annual redemption payments, each to take care of its own part of the plant and to renew those parts as often as they wear out." (Quoted by Alec C. Humphreys).

The point brought out by Mr. Humphreys is: The average life should not be calculated by the method used in determining the average life on the straight line basis for this term of years, as found in the compound interest tables. If the calculation were made in that manner, the depreciation fund would be used up many years before the estimated life of the plant would have been reached.

The following table, taken from the Wisconsin Commission Report (U-44), shows the results of the two last mentioned methods:

Method I.

Class	Estimated Life-Yrs.	Depreciable Value	Annual % Reserved on 4% basis	Annual Fund
A	5	$ 121	18.46	$ 22.3
B	8	350	10.85	38.0
C	10	651	8.33	54.2
D	12	8,354	6.66	556.4
E	15	16,526	4.99	824.6
F	16	6,784	4.58	310.7
G	20	27,127	3.36	911.5
H	50	8,238.	.66	54.4
Total		68,151		2,772.1

$$\frac{2772.1}{68,151} = 4.07\%^{*}$$

&

Method II.

Class	Estimated Life Years	Depreciable Value	Times renewed in period 50 Years	Dollars required in 50 Yrs.	Dollar Years.
A	5	$ 121	10	$1,210	6,050
B	8	350	6.25	2,188	17,504
C	10	651	5	3,255	32,550
D	12	8,354	4.16	34,753	417,036
E	15	16,526	3.33	55,032	825,480
F.	16	6,784	3.12	21,166	338,656
G	20	27,127	2.5	67,818	1,345,360
H	50	8,238	1.	8,238	411,900
		68,151		193,660	3,405,536

$$\frac{3,405,536}{193,660} = 17.54 \text{ yrs.}$$

*When placed at compound interest, the average life reduces to 17.47 years.

The difference in the composite life is due to the use of the compound interest tables which are not carried out far enough for this particular case.

With the sinking fund method, the money is expected to remain invested until the expiration of the term of years which is estimated to be the life of the apparatus under consideration. However, if the money of a part of it is drawn at the end of five years, or some other period, which was used in figuring the average life, the interest earning capapdity of the fund is reduced. Mr. Humphreys works ont an example of a plant having depreciable property valued at $500,000.00 and invests the sinking fund at four per cent. In working it out for the separate items, $10,163.00 has to be set aside each year. The average life being determined in the manner just spoken of, it is found to be 35 years. If the sinking fund is invested at four per cent for th 35 years, the amount laid aside each year will be $6,790.00. He then works out in detail and shows that at the end of fifty years, -- the life of the longest item in the table - - the depreciation fund would be $514,041, deficit. We see care and judgment must be exercised in figuring the average life and the rate of depreciation for a utility or any industrial plant.

Methods used by Commissions.

The utility commissions look over each individual company under their jurisdiction and determine the rate of depreciation to the best of their ability for this particular plant. Then they apply whatever method seems best. The New York Commissions use a plan which seems fair to the companies in determining the rate of depreciation for a utility. They have the company go over the operation costs for several years, as well as all other expenses and allow the company to determine what rate of depreciation will be sufficient. The commission then looks over the book to see if the rate is correct. Usually their is no danger of its being made to small when made by the companies.

RATES.

Having found out something about the public utility commissioner's methods in obtaining a fair valuation of a utility and particularly in the fixing of depreciation charges, it only remains to determine the relation of these factors to the regulation of rates. This is, after all the chief duty of the commissions, this and the establishment of uniform standards. Nowhere in the list of the functions of a public service commission does its position as umpure in the continual warfare between magnate and consumer become of such importance as in the question of rates. On this everything hinges, the size of the dividends payable to stockholders, the degree of satisfaction of the consumer, success, or failure.

In late years a mass of material has been gathered with respect to rates. Writers innumerable have handled every possible angle of the problem of rate regulation from every possible viewpoint. No gathering of technical men, no scientific journal is complete without at least

some references to the all-important, all-absorbing rate regulation question. Still, much remains to be done until it is finally thoroughly understood. The stupendous task of educating the public to an understanding of those matters is little more than started. Only when it has been fulfilled to a considerable extent can the co-operation between utility corporations and commissions bring real satisfaction to the consumer.

GENERAL THEORY

The fundamental theory of rates is: The rates should be such that a reasonable return is made on the investment after all charges have been paid. This determines the approximate total to be realized from consumers. The great problem is to distribute the total cost in an equitable manner. This involves two main considerations: From the standpoint of the consumer he shall be asked to pay the company a just price for the service he gets without being discriminated against; From the standpoint of the company, the price paid should cover the cost of the ser-

vice delivered to the consumer. To reconcile these two is difficult, to say the least.

The income of a utility is distributed between the fixed and the variable charges in general. For the purpose of rate making, other classifications of the cost are used, the most common being fixed, variable, and consumer's charges. To thoroughly understand rate making, these different charges must be analyzed, not only in a general way, but as to each phase of the case in particular.

Fixed Charges.

The fixed charges, sometimes called demand, standing capacity, or investment charges, are independent of the load being carried, but depend on the maximum demand, or, as it is commonly termed, the "peak" load. This naturally determines the amount of the investment or capitalization. These charges are constant, invariable. They are made up of the following:

Depreciation
Profit or dividend
Interest
Insurance (Fire, Boiler, Damage, Life)
Management
Advertising
Rent
Taxes
Miscellaneous Items.

How the depreciation charge is calculated, we have already shown.

The profit or dividend is fixed by the stockholders, or the utility commission, in the case of an established business. During the time when a plant is building, a dividend is of course out of the question. In the former case, the rates are so adjusted, that there will be a fair profit, generally considered as 5-8 per cent. of the capital.

The amount of the interest to be paid annually, or semi-annually for that matter, is found by the rate which money commands in that part of the country in which the plant is being established. That is to say, the interest depends largely on the locality, although the business reputation of

the men or interests promoting the project should not be totally disregarded.

The other items in the above classification are all seen to be constant in value and self-explanatory in nature.

Variable Charges.

The variable costs are known also as operating, running, or output charges. As might be seen from the nomenclature, these are the costs caused by the actual consumption of gas, electricity, water, or whatever the commodity is that is sold. The chief items that come under this head are

- Labor
- Fuel
- Repairs and Maintenance
- Operating Supplies
  - (Water
  - (Oil
  - (Packing
  - (Waste, etc.

Miscellaneous Items.

Disregarding the consumer's charge, that is to say distributing its different items between the general, fixed, and variable cost, we find that

in many cases the former is about 40 per cent and the latter 60 per cent of the total. For water power plants the proportion of fixed charges is greater than for steam plants.

Consumer's Charges.

The consumer's charges include the following:-

Removing and resetting meters.
Meter and fitting department, labor
Meter and fitting department, suplies, etc.
Maintainance of service.
Maintenance of meters.
Collection salaries and commissions.
Reading meters and delivering bills.
Collection supplies and expenses.
Consummer's premises expenses.
A part of the general overhead expense.

This is the expense chargeable to the customer exclusive of the cost of current actually used. If the rates are to be made in proportion to the cost of service, it is evident that the consumer's charge is a vital factor, which is not to be disregarded.

The part which these charges play in rate making will be taken up a little later.

Theories of Rates.

Coming back now to rate systems, we find that the original method used was the flat rate per lamp. Each consumer was charged a certain sum for every lamp installed on the premises. This is an unfair system for

different reasons. The chief one is that the length of time of use is unsettled, and the amount of current used has no bearing on the cost. That this sort of a rate tends to waste and unfair discriminations, is self-evident. If all the costs were fixed, this rate would be satisfactory. But this and the operating costs to be considered, also, and therefore the flat rate per lamp cannot be accepted as a proper system.

Another one of the earlier systems of rates was the straight meter rate. On this basis the consumer pays for the amount of current used, no other charges being made. This goes to the other extreme for the rate takes care of only the variable or operating costs. Under this system a consumer using 100 watts for one hour would pay the same amount as one that uses 10 wats 10 hours. The former necessitates an equipment ten times the size the latter does, and yet is charged the same rate. Manifestly this rate is also highly discriminating and unfair.

A system that would consider intelligently the rate necessary to cover both the fixed and the operating costs would certainly be preferable, to either of the above. This is what has been done and with considerable success, too. The costs are analyzed and classified un-

der fixed, operating, and consumer's charges. It is assumed that the rates be proportional to the cost of service; therefore each consumer is charged a fixed amount depending on the size of installation, an amount, proportional to the quantity of current used, and the consumer charge is made in addition. The total amount to be collected from customers having been determined from the agreed per cent profit, it seems an easy matter to fix a rate of the proper size to cover the costs. The operating and consumer's charges can be distributed proportionately among the different consumers, and it is claimed by some that the same can be done with respect to the investment charge also. However, the consensus of opinion among experts is that the best that can be done is to average the fixed costs among the consummers, and that the other charges are really covered on the basis of average also. However, that may be, the aim in this rate system is to make the rate proportional to the cost, (the fixed, variable, and consummer cost). It has been widely applied after through investigation, and has found many advocates.

Let us develope this cost to serve a little farther. For the sake of simplicity a division of the costs into the three broad classes just mentioned, although a

much more detailed division might be made. Disregarding for the moment the consumer's charge, the problem of proportioning the total cost between capacity and output cost confronts us. No hard and fast rule can be laid down which would apply to each case for the following factors must be considered. Whether the plant is operated by steam or water, whether it is operated alone or in connection with other utilities, the cost of construction and development of the business, the character of the management, the conditions under which it operates, and many other facts. The Wisconsin Commission gives two methods of apportioning the expenses, one applicable particularly to water, this other to steam operated plants. The percentage given are based on actual results as determined from the reports of the utilities in the Badger State.

Separation of Costs over Capacity and Output.

Costs	Water Power		Steam Power	
	Output per cent	Capacity %	Output per cent	Capacity per cent
Generalization				
Power plant wages	30	70	64	36
Fuel for power	100	--	100	--
Oil and grease	50	50	100	--
Misc. power plant exp.	50	50	---	100
Maintenance steam plant	50	50	100	--
Maintenance electric "	75	25	100	--
Main. Buildings and fix.	---	100	---	100

Costs	Water Power		Steam Power	
	Output per cent	Capacity per cent	Output per cent	Capacity per cent
Distribution				
Operating arc lamps	80	20	100	---
Renewing incandescents	100	--	100	---
Misc.commercial service	50	50	100	---
Substation expense	20	80	100	---
Main.of lines street arcs	20	80	---	100
" of lines commer. ltg.	20	80	---	100
Main. service lines	20	80	---	100
Main.street arcs	50	50	100	---
Main. commercial arcs.	50	50	100	---
Main.street incandescents	100	--	100	----
Maintenance motors	60	40	---	100
General				
Salaries general officers	--	100	---	100
Salaries clerks	20	80	---	100
Printing & stationery	25	75	---	100
Advertising & attractions	20	80	---	100
Injuries and damages	60	40	---	100
Insurance	--	100	---	100
Main.office buildings	--	100	---	100
Miscellaneous off.exp.	30	70	---	100
Misc.general expense	30	70	---	100

It will be noted that the fixed charges are greater in water operated plants than in those which use steam.

What part of the Investment is a customer responsible for and what rate should be fixed for him? This is the question which is the most perplexing in the"cost to serve" rate theory. It is possible to ascertain what portion of the operating and consumer's charges a custom

er should be asked to carry, but how about the "investment cost? Much theorizing and experiementing has been done by rate experts to find a solution of this problem. The assumption is made in this theory that the peak load is a direct indication of the investment which is necessary. It is on the basis of the peak that this theory is elaborated, and that part of the rate which is to cover a consumer's part of the total fixed charges is based on his peak responsibility. This is a difficult proposition to determine, and attempts have been made to ascertain it by the use of two theories, one based on the maximum demand, the other on the connected load, of a consumer.

Let us analyze the maxium Demand theory of rate calculation.

Step 1.

We assume a direct relationship between the peak and the investment.

Step 2.

Dividing the yearly profit plus taxes plus insurance plus depreciation charges by the Investment Peak load and multiplying the result by the efficiency of distribution, we have the yearly amount of investment charge assignable to each K.W. of Instantaneous Demands.

Step 3.

Assume that there is a direct relationship between each consumer's maximum demand and his share of the instantaneous demand or his peak responsibility. However the sum of the maximum demands of each customer greatly exceeds the total, i.e. the peak load, which fact necessitates the use of a "diversity factor". Using this factor, we now have the annual investment charge assignable to each k.w. of maximum demand for each customer.

Step 4.

To determine a customer's maximum demand is required if his annual investment charge is to be fixed. This can be accomplished by means of maximun demand meters or by taking averages of the maximum demands for a similar case of service under similar conditions as found elsewhere. This is necessarily a very approximate method, and therefore the rates, calculated by this method, are so often inaccurate.

Step 5.

The annual investment charge as found by Step 3 divided by 12 gives as result the monthly investment charge per K. W. of maximum demand. Multiplying this by the individual maximum demand, as found in Step 4, we arrive at the individual monthly investment charge, which we started out to find.

Having determined the individual investment charges, the next step is to get it into the bill. This is done quite simply by adding a flat charge per K.W. of maximum demand. This, however, is undesirable because it is unpopular with the customers, Other methods have been tried.

In one instance a certain amount of K. W. hour, consumption is assumed, and a base rate per K.W.h. fixed on that assumption, so as to provide for both the investment and customer's charges.

The obvious objecton to this (and the entire theory teems with assumptions which invite criticism) is that there is no way of forcing a consumer to use the assigned number of K.W.H. If he uses less, he is obviously not fulfilling his duty in shouldering the proper part of the capacity and consumer charge burden. The assumed K.W. h. consumption should be made smaller, and in that case the charge will degenerate into a flat rate, which we decided was undesirable.

Another objection is that two customers might use approximately the same amount of current, but in different quantities. The first uses close to the

required amount monthly, the second varies his consumption from a very small amount in one month to a very large one in another. The second consumer receives the benefit of substantial discounts on his large bills, the first receives no such recompense, although he deserves it. The method is objectionable for seeming to place a premium on fluctuating, irregular use of the current.

A third undesirable point in connection with this theory, is the uncertainty of the individual maximum demand, determined from demand meters or data. When figures for residence lighting in two cities give 21 per cent and 50 per cent as the average maximum demand, the selection of a value for any particular case is necessarily a haphazard affair. And it is this feature which is the controlling factor in calculations based on this theory of maximum demand.

In view of all this we might well say that calculation of rates by the maximum demand system as a part of the "cost to serve" principle, is altogether too uncertain and inaccurate to be used in actual rate-making by public utilities. As the reader has observed, the arguments have been along the line of electric plants but they hold good with equal correctness for gas, and

water, supplying corporations.

An attempt has been made by rate experts to connect the responsibility a consumer should take regarding the investment charge with the connected load he carries.

Following somewhat along the lines of reasoning in the previous case, we have,

Step 1.

Assume a direct relationship between the peak and the investment.

Step 2.

Divide the yearly profit plus the taxes plus insurance plus depreciation charges, --- in short, the fixed charges -- by the investment peak load multiplied by the efficiency of distribution. The result is the investment charge per year per K.W. of instantaneous demand.

Step 3.

Find the diversity factor by dividing the sum of the connected loads by the investment peak load multiplied by the efficiency of distribution.

Step 4.

$$\frac{\text{Investment charge per year per K.W. of inst.demand}}{\text{Diversity factor} \times 12}$$

= Investment charge per month per K.W. of individual maximum demand.

Step 5.

Let K = Individual connected load.
Let M = assumed no. of hours use of individual maximum demand per month.
Let X = Base rate for individual maximum demand x M
Let A = Monthly customer's charge.
Let B = Manufacturing charge per K.W.
Let I = Investment charge per month per K.W. of individual maximum demand.

Then $KMX = A + K.MB + KI$ (1)

Solving for X: $X = \frac{A + KMB + KI}{KM}$, which is the proper rate to be used.

Equation (1) in words states merely that the money paid the company according to a rate X will cover individual customer's, manufacturer's, and investment charges.

The theory seems very well, but we must bear in mind that the individual consumer neither causes nor uses the investment in proportion to his use or demand and his connected load. There are such a large number of reasons governing his installation which are in no wise related to his use or demand of curcuit, that it would be illogical to assume a direct relationship between his connected load and his peak responsibility, which we have taken to be a measure of this part of the fixed charge.

These theories of relating the consumer's burden of the capacity charge to the total capacity, or rather investment, by the maximum demand or connected load methods,

theoretically worked out give rates which seem to be the true ones, but which cannot be safely applied, because the premises made are incorrect or unwarranted, as above shown. One writer, Mr. James T. Allison, Engineer of the St. Louis Public Utility Commission, advocates the use of the "expediency principle" in order to get to the real rates to be used. This is saying merely that experience and special conditions should be the determining factors in that particular phase of the cost to serve rate system which we have been discussing. But that is straying from the field of theory to that of practice. At present we shall confine ourselves to the former.

To recapitulate: The "cost to serve" theory of rates demands a division of all cost into fixed, variable, and consumer's charges; each consumer's part of the first two can be determined directly or approximately by averages; the individual investment charge can be determined only by the use of highly hypothetical assumptions, which are so uncertain that it amounts to guessing at the investment charge per customer; the method is logical in a general way, and a good guide to the rates to be established, but based too much on average and hypotheses for use without

considering other factors. We shall look into some of these later on.

Besides the "cost to serve" system there are a number of others. One of the best known and most successful ones is the "readiness-to-serve", or Doherty system. This, stated briefly, consists in making a readiness-to-serve charge proportional to the connected load of the consumer, made up irrespective of the actual K.W. hours used, with the additon of a low operating charge per K. W. h. consumed.

Most companies arrange matters so as to charge a high rate per K. W. hour for a given number of hours' use per month of the connected load, and a lower rate per K.W. h.for the subsequent consumption per month. This finds the greatest favor with consumers, and is therefore highly desirable.

Many systems and theories have been worked out. One of the most elaborate, making use of solid geometry, appeared recently in the Western Review and Electrician over the signature of Hugo E. Eisenmenger. These systems are, however, too lengthy and complicated to be taken up here. The principles involved are the same in every case.

The systems of rates for railroads are similar in so far as their costs are to be treated similarly, but tradition, expediency, and public opinion have

fixed the rates. In the case of interurban railways, we have flat rates also, their value depending mainly on distance.

Factors Affecting Rate-Making.

As we stated above, rate theories cannot be applied in practice, without modifications, dictated by experience and special circumstances. One element of prime importance is that of distance. Every enginneer who has laid out service knows perfectly well that the largest factor in delivering energy to a customer is the distance between his premises and the plant. Many experts agree that distance really affects the cost the most; then why should it not be made the determining factor? Because the consumer located a greater distance from the plant would feel himself discriminated against. The zone system, though correct from the standpoint of utility, economics, is inexcuseable from the viewpoint of fair and equitable treatment of the public..

Fixed charges depend not only upon the maximum kilo-watt demand, as is generally assumed, but on other factors also. For example, it costs more to supply electricity to a district which must be reached through conduits than one which contains pole lines. Again, the district might be so densely

populated, that it might be actually less costly to serve it by the former method. A so-called "street-charge" should be made, depending on whether over-head or underground construction is employed; if over-head, whether in country districts, where short, cheap poles can be used, or in residence districts, where large, square poles are demanded; if underground, whether the street is of dirt, or has an asphalt pavement, etc. To be really accurate, matters such as these should be considered in rate making.

A "quality charge" might well be made in many cases. This is dependent on whether the voltage must be kept steady or is allowed to fluctuate, and whether discontinued service is to be tolerated for any length of time. Where a degree of laxness is permitted, a lower rate should be charged, or wholesale discounts allowed.

An important charge, also, is the so-called "change charge". This depends on whether the customers remain on the lines year after year, or move ever few months, every removal involving changes in meters, records, etc. These all cost money, and should be covered by an additional charge of some kind, on the customer. A great number of managers take the stand

that a removal of a customer from one place to another is unforeseen and no provisions can be made therefore. They are wrong; the average of the customers who move is approximately constant, or follows some general law; hence a provision for the expense caused the company by their moving can be estimated.

A factor which is very often given thorough consideration in the distribution charge. There is a vast difference in the supply in one large quantity at a single point or if in small quantities at many separate points. The latter requires a much greater investment and operating expenses for distribution.

A difference exists between consumers who can guarantee a maximum consumption and those who cannot. This causes discrimination between contract and non-contract users; one consumer may be entitled to discounts because of a short use of a large demand, another because of a long use of a small demand; but the consumer who can guarantee neither of these conditions obtains no discounts, or at least, a relatively small one.

The distinction between retail and wholesale sales of a commodity is made also in the service of a

public utility. Some people claim that a customer should not be entitled to a discount merely because he uses a large amount of energy for a long time which increases the load factor. This involves merely a use of power which is available; not an increase in investment. Then, why should not a concession be made; why should they pay proportionately a larger ratio for power which costs less to produce? It is urged by many that the use of electricity will increase to an enormous extent in the near future; vast quantities will be sold to such concerns as railways, electro-chemical producers, pumping and large manufacturing establishments, and the like. Low rates should be made for this, as low as necessary to obtain the contract, regardless of other rates in vogue. Some extremeists favor the abolishment of all rate systems, and the establishment of special rates for special cases. This would be as much as the traffic will stand, or as high or low as may seem expedient. This, it goes without saying, is going too far, for such people lose sight of the fact that a utility is semi-public, and operates by virtue of the good-will of the people. Nevertheless, a wholesale rate for large

users or lower rate for power users in general, is not unreasonable and should be allowed.

Speaking of power users, they are entitled to lower rates, not only because they use off-peak energy, but for other reasons also. For instance, a consumer who takes a leading current in an alternating current system , is entitled to a special consideration for improving the power factor of the system, which is in general low on account of the prevailing use of induction motors. Improving the power factor amounts to increasing the capacity by causing the production of a greater number of useful watts with the same equipment. The customer who takes a leading current does the company a service as it is fitting that he be awarded.

Many public utility organizations, make it a practice to charge a minimum rate. This is necessary to cover the fixed charges, which always exist, whether the consumer uses current or not, that is, irrespective of operating expenses. These charges should also include something for a minimum consumption of current; otherwise it is necessary to charge additional for a very small amount of current used in a given length of time, generally a month. The minimum charge is recog-

nized as essential by officials and rate authorities throughout the country.

If we consider all these items which should enter in rate calculations, and there are generally a multitude of other considerations for every individual company, it is easy to understand that all rate theories are often but approximations. A system might be devised which could account for everyone of the limitations and considerations enumbrated besides dividing the total cost into the three great divisions of fixed, vairable, and customer's cost, and which would formulate a theory governing every case. We say it might, but even if it were done, it would be too problematic to be reliable. We are forced to the conclusion that rate theories are really nothing but convenient approximations. No hard and fast rules governing any case can be rightfully established.

If this is true, then how does the manager of a utility arrive at the rates imposed on a company's customers? He does not, as a rule, make the rates proportional to the"cost to serve",even after averaging out enough factors to make a simple system. He considers the cost exactly as the theorist does, but he also considers the existing rates. He then calculates

how much of a difference a change in the rates, say a reduction, would make, i.e., how many new customers he would gain, how many he would lose, how much the expenses would be to run additional pole lines or conduits, etc. If he concludes that the rates could be changed with no serious detriment to the customer, and the income and reputation of the concern would not suffer, he will probably make the change. Quite an arbitrary method, to be sure, but one that is applied oftener than any other. It has this advantage, at any rate, that all local conditions will receive due consideration, and that the rate is not fixed merely by complying with a general theory. Experiment and judgment count more than mere theory in the actual establishment of public utility rates.

R. S. Slade in an article in the General Electrical Review, for April, 1911, offers a number of essential considerations that ought to be observed by anyone who is fixing rates in accordance with the so-called "practical" system:

1. Total price: The total price of all the products of the company, should equal the total of the costs. In other words, the company is entitled to a fair profit and no more.

2. Minimum Price: The price to any individual, or rather to any class of customers, should never be less than the added costs caused by the added business, or a net saving in expenses if business is lost. This is called the increment cost.. By class of customers we mean any division for which it is practical to have a separate price, in this connection.

3. All the prices cannot be set at the lower limit, because this would not give sufficient income to the company.

4. Maximum price: No price can be permanently more than it would cost the consumer to provide himself with the service in some other way.

5. All prices cannot be so at the upper limit, because if not a monopoly, this would immediately invite competition; if a monopoly, it would give too much income and invite government regulation.

6. Actual prices between these limits: With a given set of rates a change would be inaugurated as follows: Add any proposed rates that apply only to the customers not now using the service, provided they will produce more income than the increment cost. Since, by hypothesis the customer cannot afford the present rates, the new rates will always be lower than the former ones, and it follows that the new rates should not be lower than necessary to obtain the business.

7. Any rate to a certain class of customers should be cut, provided the new rate will develop new business which will bring enough to pay its increment cost and also make up for the loss of income from the present consumers.

8. If any rate has developed a class of customers so that by losing the business more should be saved in exprenses than the loss of income, than we should ratse that raise or rather re-classify and raise the rate of the unprofitable class, but not more than to make that class profitable.

9. If an existing business gives more than a reasonable profit, the rates should be reduced, either for all customers or for those classes which are burdened most by the existing rates. The latter is the best, for it is most likely to further develop the business. Instead of lowering the rates the service might be improved, which amounts to the same thing, for by virtue of it the customer gets more for his money.

10. If the expenses for some reason should go up heavily, an increase in the rates seems logical. In this case it is better to increase the rates only for that class of customers which the existing rates bore least heavily.

Care must be taken to analyze each case thoroughly. Usually the increased expenses are traceable to one particular class of customers. As long as this class remains profitable, that is, as long as it still brings in more income than would be saved if the business were lost, raising the rates would not be absolutely necessary, especially if the existing rates bear heavily on that class.

If, however, the increase in expenses brought about a state of affairs so that these classes brought in less income than would be saved if the business were lost than the rates should be increased for these classes, at least to that point where they would produce more income than their increment cost.

The above discussion has been limited to electric light and power companies. The same principles, hold, however, for any public utility in a general way. In railway rates many other aspects present themselves. The unit for determining rates is not the kilowatt, but the car-hour or the car-mile. The rates maker for a railway company is limited to a flat rate in most cases, especially in cities, for tradition and precedent have established the five cent fare. Although the flat rate

is not correct from the standpoint of economics, it is of great assistance in preventing congesting in the central districts of cities. The problem in that case is to distribute the costs to be covered in the most satisfactory manner.

The service done the public by a railway is transportation, therefore the distance to which a passenger is carried is the logical determing factor. However, it is impossible to establish a system under which each passenger would pay only for the service done by the company in carrying him a certain distance, and its enforcement would be still more difficult. The short-haul passenger pays for the extra expense caused the company by the long-haul passenger, and in this way the operating costs are equalized.

When very long distances in connection with street-railways are to be considered, the zone system must be used, although it does work injustice to a great number of passengers.

Another factor in railway rates is the rapidity and comparative comfort of travel. It is quite feasible, for example, to charge two rates between the same points The New York Commission ruled that a five cent rate from New York City to Coney Island should be charged for

surface car transportation and ten cents for rapid transit (Elevated railroad).

In interurban railway work, the rates are adjusted according to the costs to be covered by the company. An important item to be considered in this connection is the competition from the steam railroads. It is necessary to make concessions in the rates when the older form of transportation is encountered, on account of the comparative lack of speed and comfort with which the electric railway interurban passenger has to put up ~~with~~ .

So much for the rate theories and practice. Now we shall investigate the part the public utility commission play in these matters.

The commissions can be divided into two divisions according to the functions they have in regulating the rates of the utilities under their jurisdiction. The one class of commission sees to it that the maximum rate or some other particular rate is not too high as to return an unreasonably high dividend on the fair value of the prosperity used in the service of the public. This sort of a commission has very limited functions, as can be seen from the above; it merely acts as a check, a brake, on the utility companies.

The second class of commission has greater powers. It makes an attempt to regulate rates intelligently, arriving at the exact cost of the energy used and prescribing rates so as to distribute the cost, including a fair return on the investment. That is to say, they regulate rates on the cost to serve basis. This is particularly the system of the Wisconsin Commission.

In general, let it be said, the commissions do not purport to follow any definite system or systems.

Each case is examined as to its merits, in detail, which generally involves a valuation of the company's assets and business and a study of the peculiar conditions to be met as well as the rates which have been in use. That rate or system of rates which will be the fairest to both company and consumer will then be advocated. Each case is thoroughly investigated and the proper rate is prescribed to fill the particular needs found. That is the attitude which the average public utility commission adopts, and the results which have followed have been highly satisfactory.

From the preceding discussion we can gain a faint idea of the activities of the public service commissions, of the systems which they follow in arriving at the correct value of a utility, of the methods adopted and advocated in fixing the depreciation charge of a plant, and of the influence it exerts in the regulation of

rates, as well as something about the theory of rates in general. No one who is unbiased and progressive in his views on matters affecting the corporations which serve the public can deny that such commissions have been great agents for justice for investor and consumer, that their establishments have been a step in the right direction, and that the future holds more and greater benefits in store which are to be derived from these same commissions.